PAN-PACIFIC ENTOMOLOGIST
January 1981, Vol. 57, No. 1, pp. 245–250

A DURABLE, LIGHTWEIGHT NET AND A MANUAL ASPIRATOR FOR COLLECTING AQUATIC ORGANISMS

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The net and aspirator described herein were designed for use in collecting aquatic Coleoptera. However, the net has been used for collecting a wide variety of aquatic invertebrate and vertebrate organisms, and the aspirator works just as well on terrestrial insects.

When I first started collecting aquatic insects about 30 years ago I tried using one of the lightweight aquatic dip nets sold for student use by some biological supply companies. Although these nets are satisfactory for dipping up surface inhabiting taxa, the circular net frame invariably bent when the net bag became laden with aquatic vegetation or when it was pushed through dense growths of aquatic plants. The heavy accumulation of vegetation in the net occurs frequently when one collects in grassy margins of aquatic habitats where some of the most interesting aquatic forms are found. After I had straightened the net frame several times, the frame would invariably break. Therefore, a sturdy net was necessary for this type of collecting.

I next tried using a sturdy dip net with a triangular frame, the base of which was imbedded in a lead-filled ferrule attached to a heavy wooden handle. However, the net was very heavy when the additional weight of wet vegetation was added to it or when the net was used in streams with rapid current. The net proved to be very fatiguing after only a few hours' use; in time, the wooden net handles rotted and broke and had to be replaced.

Consequently, I constructed an inexpensive, sturdy, lightweight net (Figs. 1–3) that has proved to be very satisfactory. The net may be constructed with a single piece handle or with one that can be dismantled (Figs. 2, 3) so it will fit into a suitcase for travel. The items used in constructing the net are as follows.

1—Aluminum tubing, 8′ long, 1″ in outside diameter
1—Net bag, purchased from biological supply company
1—Copper or brass wire, about 90″
1—Metal rod, ⅜″ diameter and 42″ long—for net frame
1—Crutch tip, 1″ inside diameter
4—Screws, roundhead, brass, no. 7, ⅝″ long

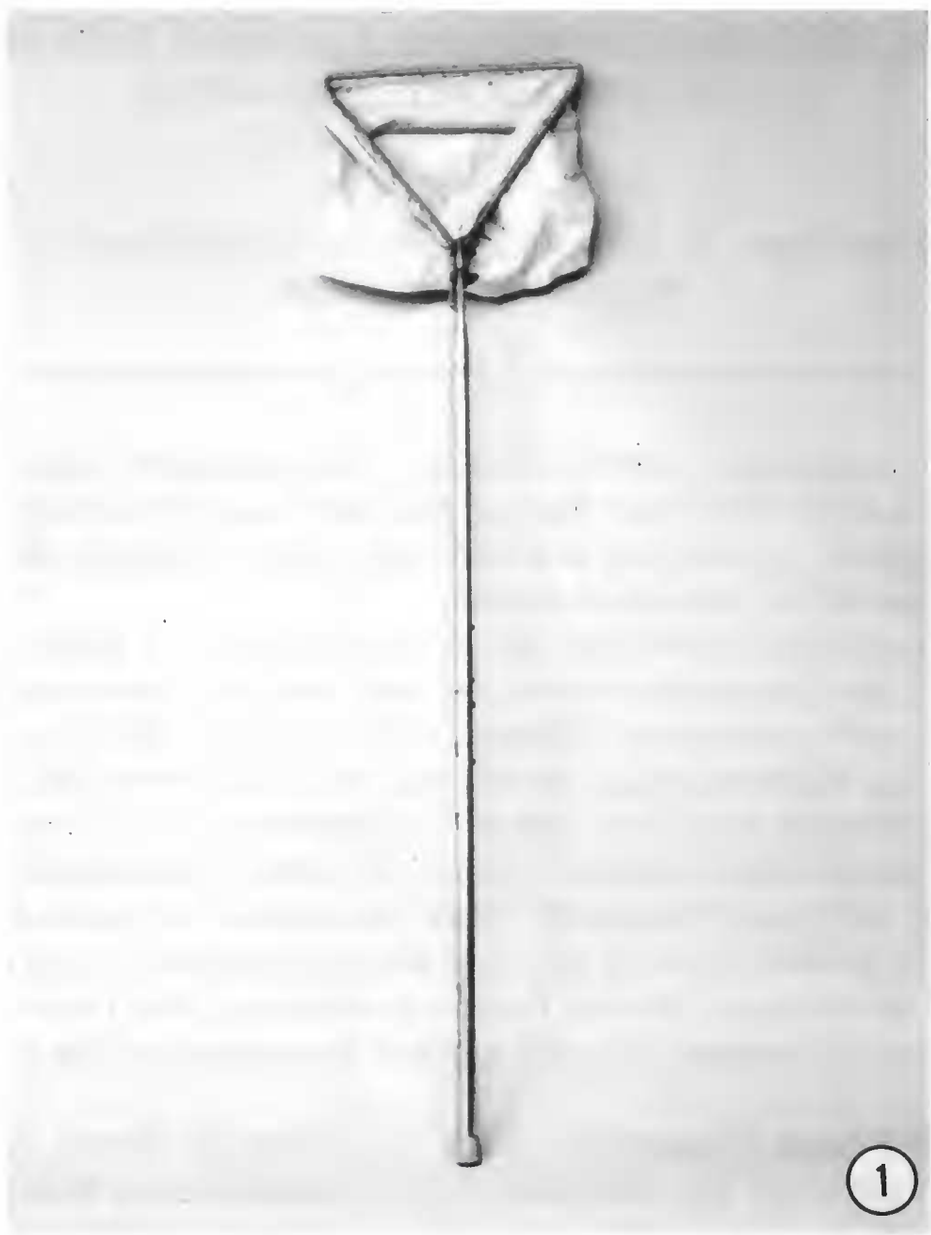
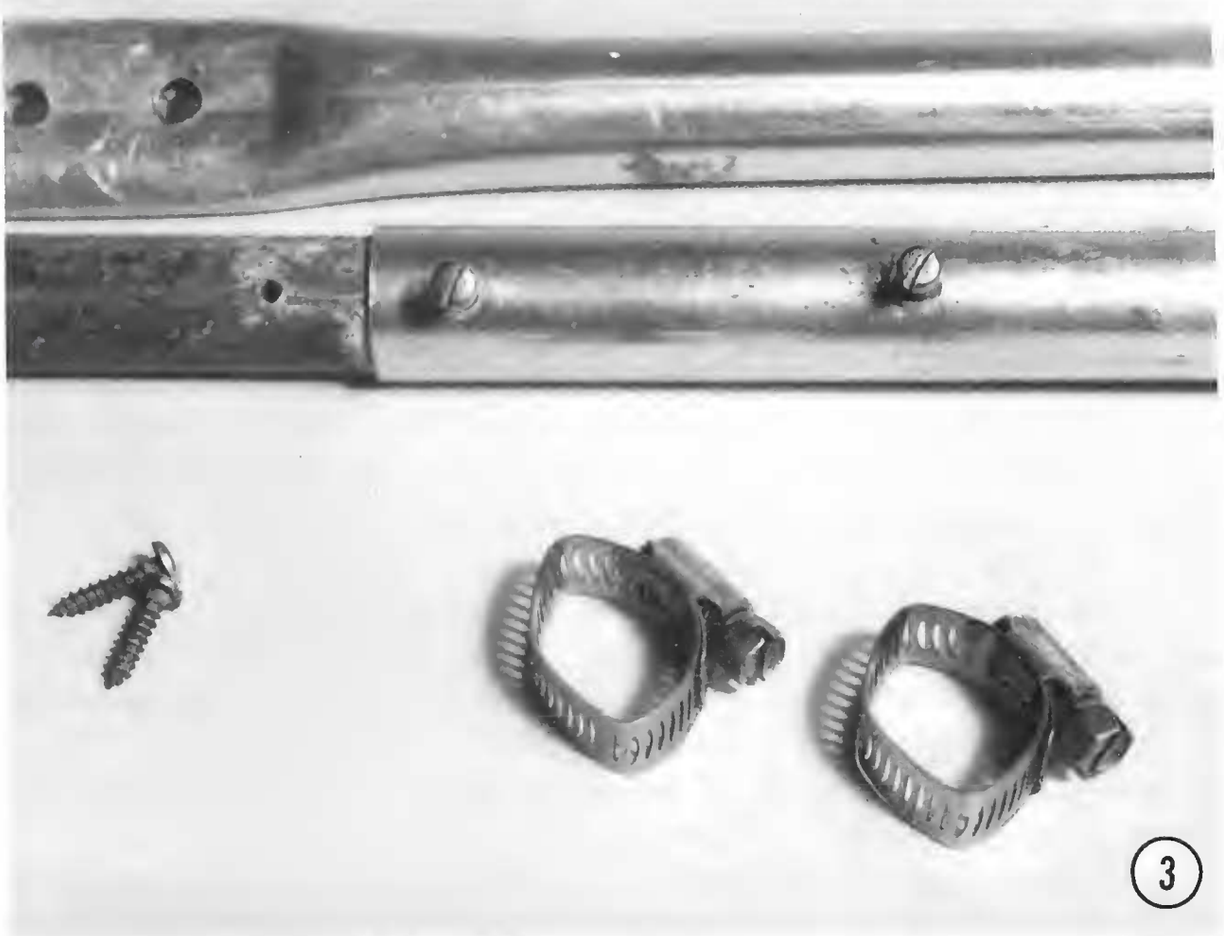


Fig. 1. Aquatic net, complete.

1—Wooden dowel, ¾″ diameter and 8″ long
1—Copper or brass tubing, ⅞″ outside diameter, 8″ long
2—Hose clamps

The aluminum tubing for the handle is usually available in two standard lengths of 6 or 8 feet and with a smooth or knurled surface. I purchase the 8-foot length and make two 4-foot handles from it; the overall length of the net is then about 5 feet. If a longer net handle is necessary, the 6- or 8-foot length can be used as purchased or shortened as desired. I prefer the tubing with the knurled surface because it provides a firmer grip and holds paint better than the smooth surface. The iron rod used for the net frame does not need to be rust resistant if the net bag is dried before storing, but a rustless metal rod at a slightly higher cost may be desired. So that com-



Figs. 2, 3. Aquatic net. Fig. 2, Dismantled. Fig. 3, Crimped end of handle for attachment of net frame (upper), copper/wood plug in net handle (middle), brass screws and hose clamps (lower).

mercially available net bags could be used, the dimensions of the net frame are the same as those of the bag. The rod can be bent in a sturdy vise in a home workshop to form the triangular net frame; the leading edge of the frame is 13¼″ wide, the sides are 11″ long and the basal pieces that are clamped to the handle are 3½″ long on one side and 2½″ long on the opposite side (Fig. 2). The shape of the new frame may be circular, rectangular, or triangular depending on personal preference. I have tried all three forms and have found that the triangular frame is most satisfactory because it offers a straight edge and the acute angles can be worked more easily through thick vegetation and into small spaces that would be inaccessible with other types. The crutch tip on the end of the net handle is used only to prevent the handle from scratching the palms of one's hands or the paint of car interiors, etc., and to keep mud out of the end of the handle.

In order to adapt the net handle so that it can be carried in luggage I find the following method works well. (1) The aluminum handle is cut in half, i.e., cut into two 2-foot lengths. (2) An 8″ piece of copper tubing that fits snugly inside the aluminum handle is cut. (3) An 8″ wooden dowel that fits snugly inside the copper tubing is cut. (4) Then the copper tubing filled with the wooden plug is inserted 4″ into the end of one section of the aluminum handle; two holes are tapped through the aluminum and the copper tubing; and brass, round-headed screws are inserted into the holes. (5) The other half of the aluminum handle is then slipped over the still exposed 4″ piece of copper tubing and two screws installed as mentioned above. Placing wax, soap, or oil on the screws before inserting them will ease their removal. The inner copper tubing prevents the wooden dowel from swelling and the handle will slip apart easily. Thus the dismantled parts of the handle can be reduced to pieces not more than 24″ long and these can be packed in luggage.

The hollow aluminum tubing has two minor disadvantages. It can be dented or bent if subjected to an unusually severe blow; and in some waters a chemical reaction occurs that causes a temporary dark stain on the hands. This stain can be washed away easily with soap, but staining can be prevented altogether by painting the handle with a metal paint.

The new frame is fastened to the handle in a manner similar to an ordinary aerial insect net (Figs. 1–3). However, the end of the handle is partially flattened to receive the ends of the net frame and two hose clamps replace the metal sleeve of ordinary nets. With hose clamps as illustrated (Fig. 3) and sufficiently large slots in the heads of the brass screws, a coin may be used to dismantle the net; otherwise a screwdriver is needed.

The net bag may be purchased or constructed, if satisfactory sewing equipment is available. The bag may be made of any satisfactorily strong netting of desired mesh. The upper edge of the bag should include a stout ¼″ diameter cord in the hem to prevent the bag from tearing away after it is wired to the net frame. The entire net bag should be inside a stout,

Fig. 4. Aspirator and ground cloth.

Photographs by Victor Krantz, Smithsonian Institution staff photographer.

lightweight canvas sleeve to prevent snagging the netting on limbs, thorns, etc. The sleeve slightly impedes drainage of the water from the net but this slight disadvantage is far outweighed by the prolonged "life" of the bag. The net bag is wired to the frame so that the leading edge of the net is the iron rod and not the net bag itself. This too decreases damage to the net bag and prolongs its "life." I have used copper wire to fasten the bag to the frame because of the ease of bending it around the frame and because it does not rust and thereby weaken the bag as some other wire might do.

I have used the type of aquatic net described above for 20 years and it has been used by students in my aquatic entomology class at the University of Maryland for 14 years. Only once, after 4 months of daily use, did a handle break. The break occurred at a stress point at the end of the copper/wood plug closest to the net frame. The 4″ piece of aluminum tubing that broke loose was removed and the remaining piece of the handle was slipped over the copper/wood plug, new holes were punched with a nail, the screws secured, and the net, although 4 inches shorter, was as good as new.

Most individuals who have used oral aspirators for collecting insects probably have had the unpleasant experience of aspirating fine dust, tiny spec-

imens, or acrid defensive insect gases into their mouths; and many have experienced a dry throat reaction from these aspirators. Luckily, few have gotten myiasis of the sinuses as reported by Hurd (1954). Because I was preparing to collect in the Neotropics and did not want to experience the same problems Hurd had, I purchased a mechanical aspirator. However, this aspirator was very large and awkward; it promptly rusted from water sucked into it with the aquatic beetles and it soon ceased to function. I then constructed an aspirator (Fig. 4) with a rubber pressure/suction bulb which is available from scientific supply dealers. The bulb is small, has no metallic parts to rust, and is durable. With this bulb, one must squeeze the air from it and suction occurs when the bulb is released. The amount of pressure put on the bulb combined with the speed by which the bulb is released regulates the force exerted on the insects being aspirated. The aspirator may be used with a plastic or glass vial which is dry or contains alcohol.

This device seems slightly awkward when first used because one expects the squeezing action to aspirate and this is not true with this device. However, the user becomes a believer after using this aspirator for only a short time. When small beetles are abundant in a net or on a ground cloth, several are often aspirated with one release of the bulb and all specimens are collected much more rapidly and with less damage than when collected with forceps or fingers. Where schistosomiasis organisms may be present this aspirator is useful in reducing exposure to them and provides greater peace of mind. I have used the type of aspirator described above for 17 years and would not want to be in the field without one. Eventually the multiple squeezing of the bulb causes it to weaken and break, but replacement bulbs are inexpensive.

The aspirator works well when aquatic plants and specimens are dumped onto a nylon ground cloth. The ground cloth, 2½ feet square, drains rapidly; the insects, free of mud, crawl out of the drying plants and are easy to see and collect with the aspirator. Triangular pockets may be sewn in the corners of the ground cloth, and when sticks are placed in diagonal corners the cloth will serve as a beating cloth.

Literature Cited

Hurd, P. D., Jr. 1954. "Myiasis" resulting from the use of the aspirator method in the collection of insects. Science, 119(3101):814.